Pressure-Sensitive Paint Research at GRC

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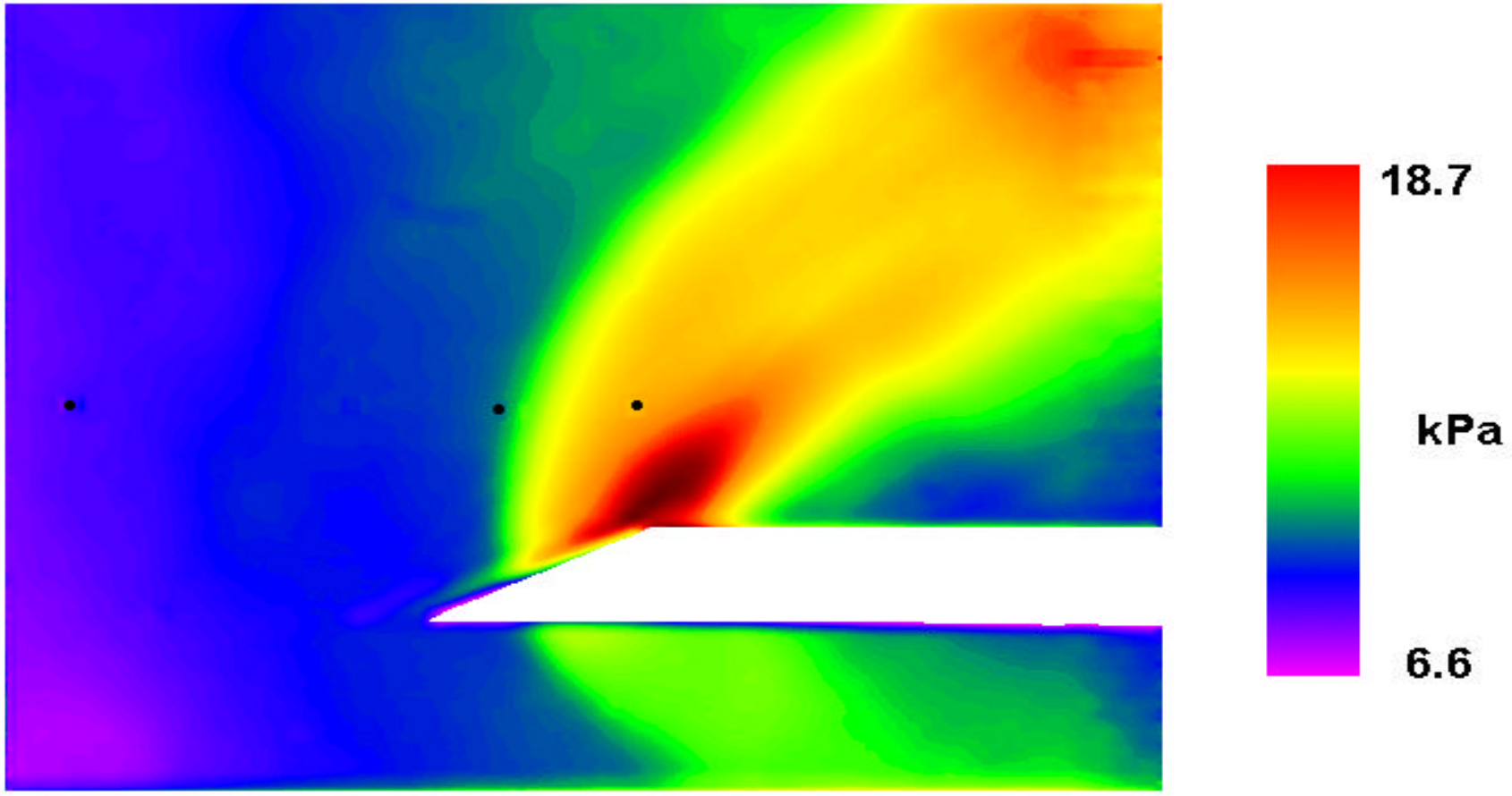
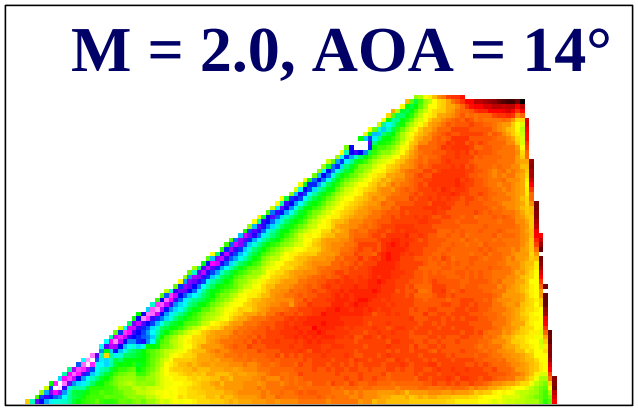
Outline

- **Overview of Pressure-sensitive paint**
  - **What is PSP and why?**
  - **How it works**
  - **History of PSP**
- **Unique applications at GRC**
- **Conclusion**

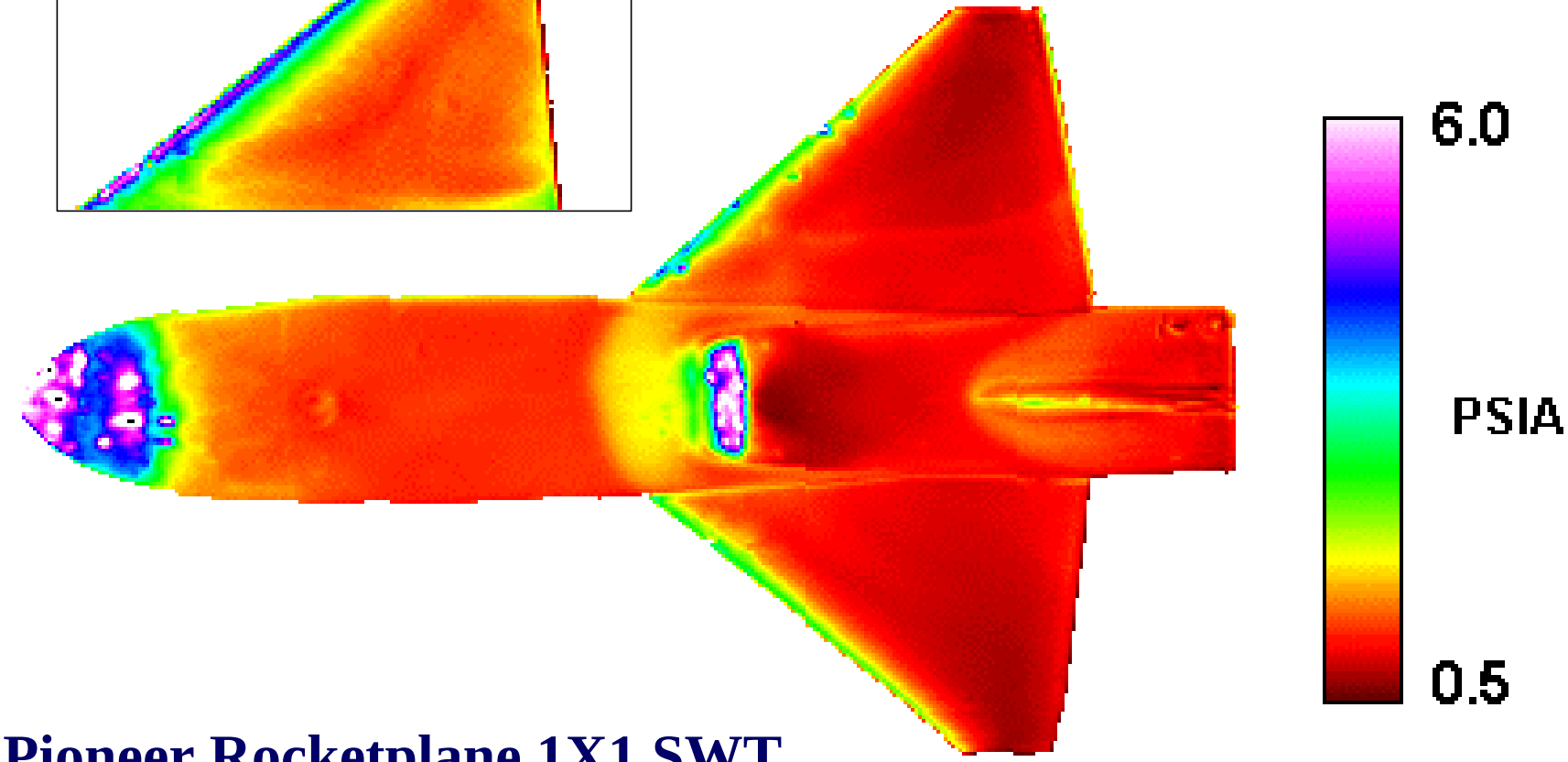
Pressure Sensitive Paint is a non-intrusive optical technique to make global surface pressure measurements



M = 2.0, AOA = 14°

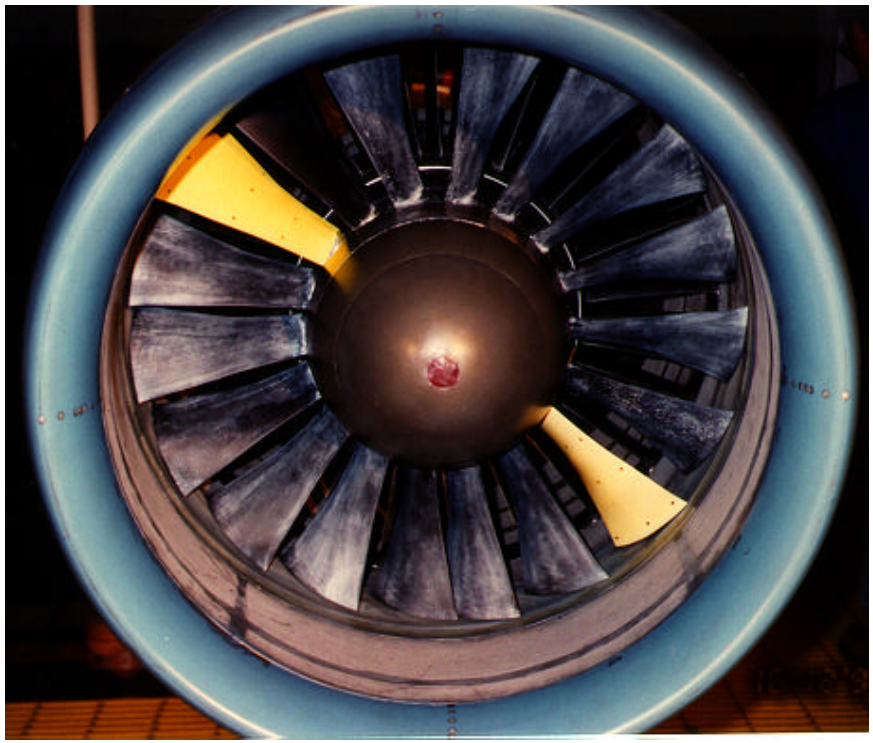


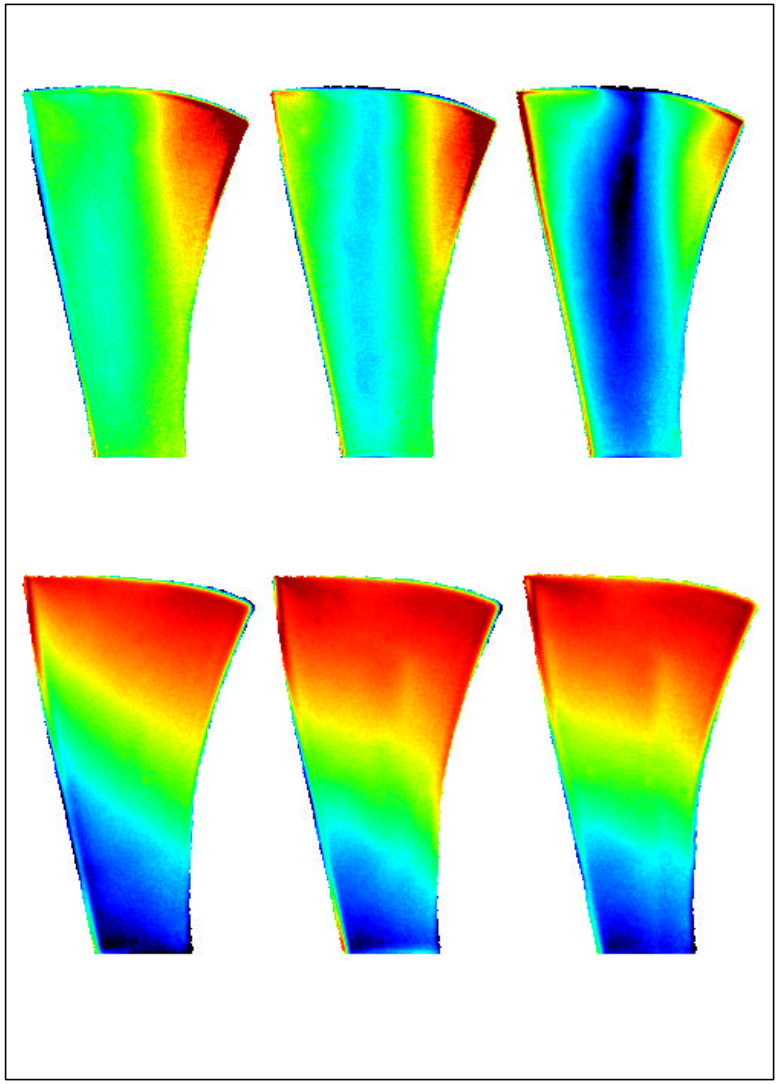
Pressure Sensitive Paint saves money by saving time.



Pioneer Rocketplane 1X1 SWT
M = 2.0, AOA = 0°

Pressure Sensitive Paint provides information not obtainable in any other way.



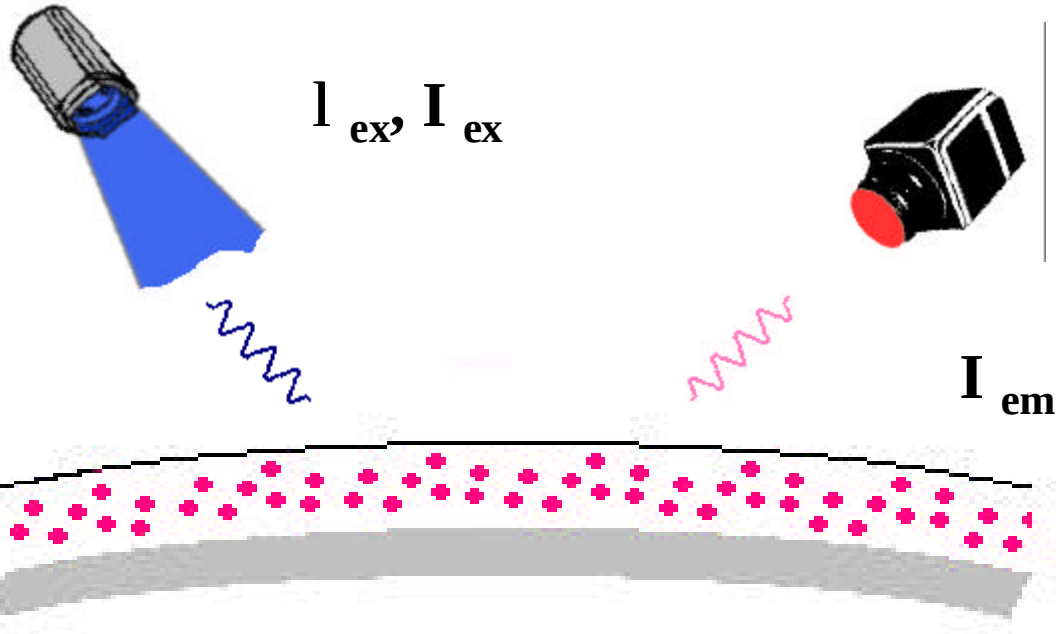


PSP Basics

Excitation
(Filtered Lamps
Laser, LED
Flash Lamp)

Stern-Volmer Equation

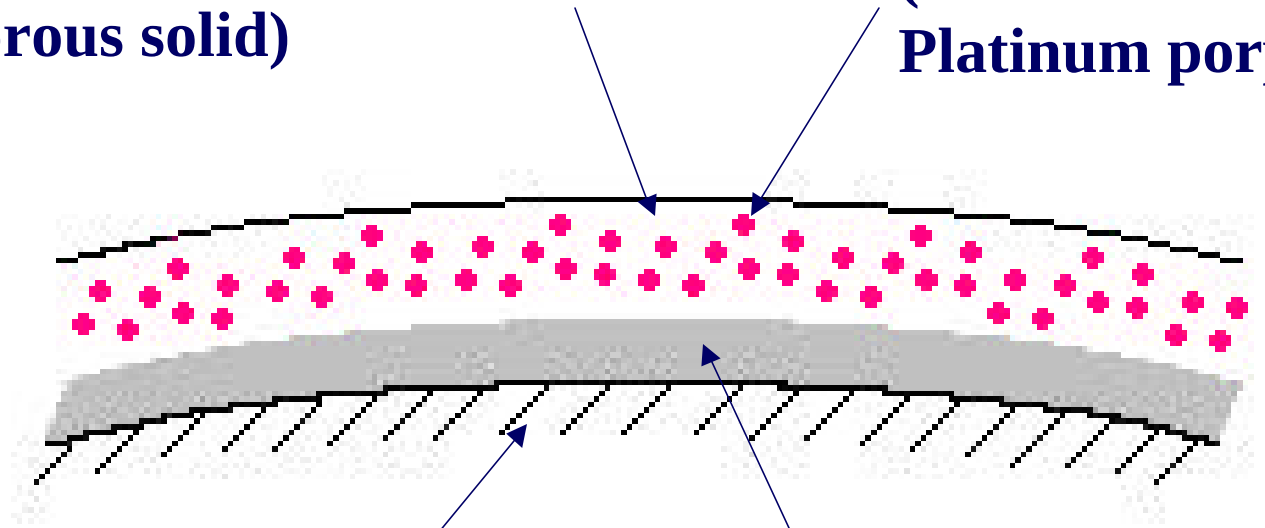
$$I_{REF}/I = A + B(P/P_{REF})$$



The Anatomy of a PSP

Oxygen permeable binder (polymer, silicone rubber or porous solid)

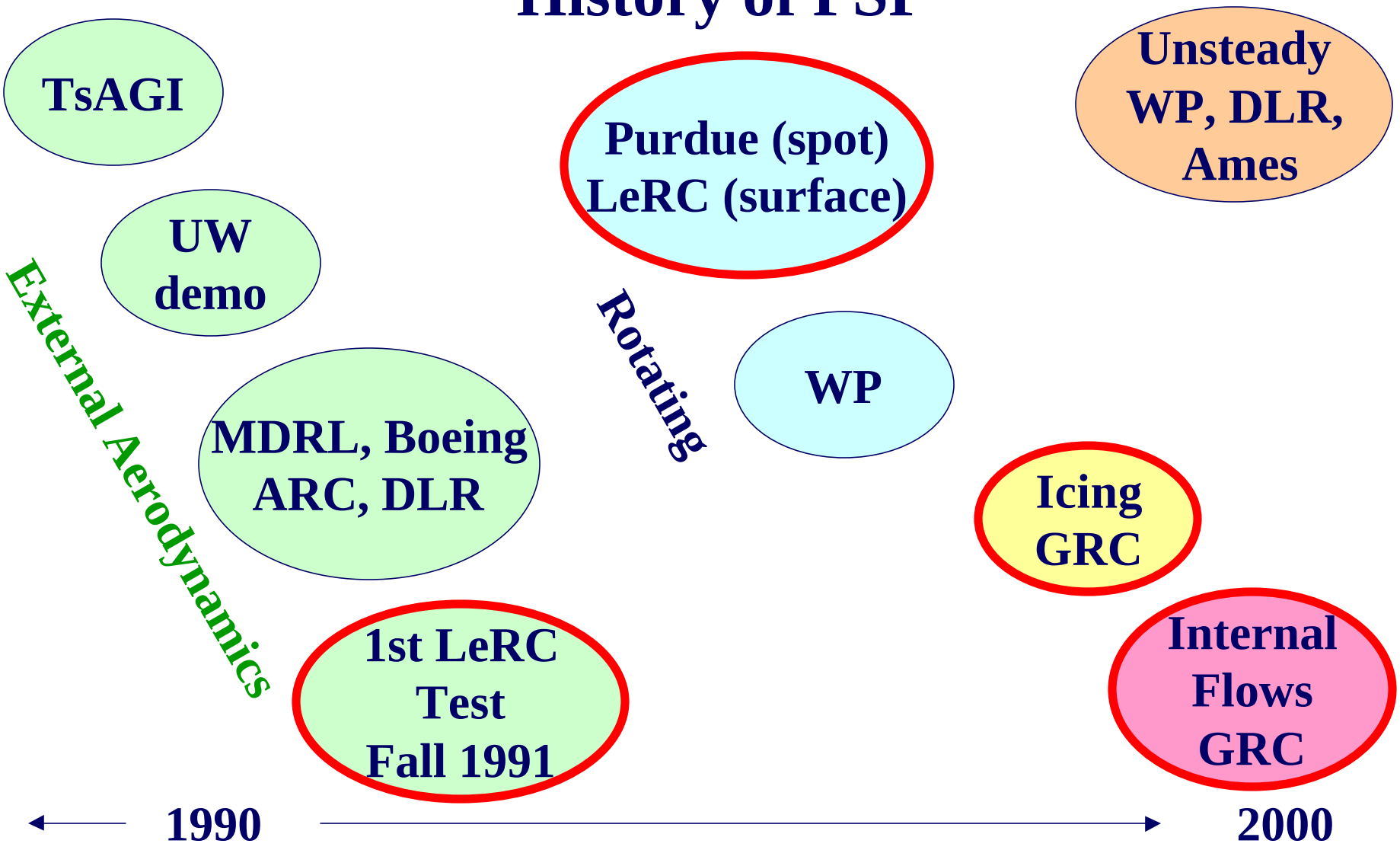
Luminescent Molecules (Ruthenium complexes, Platinum porphrins)



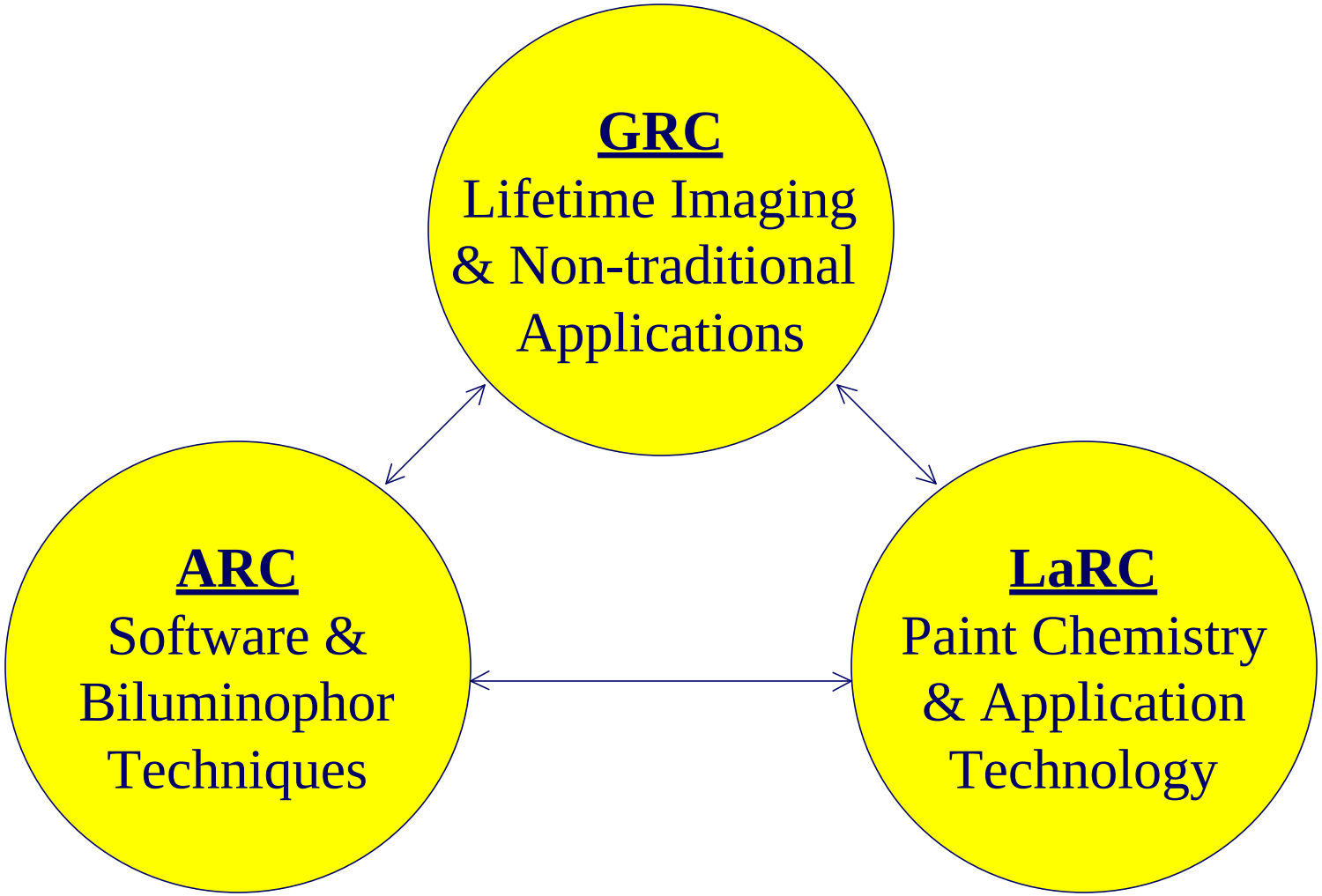
Model surface

Undercoat scattering layer

History of PSP

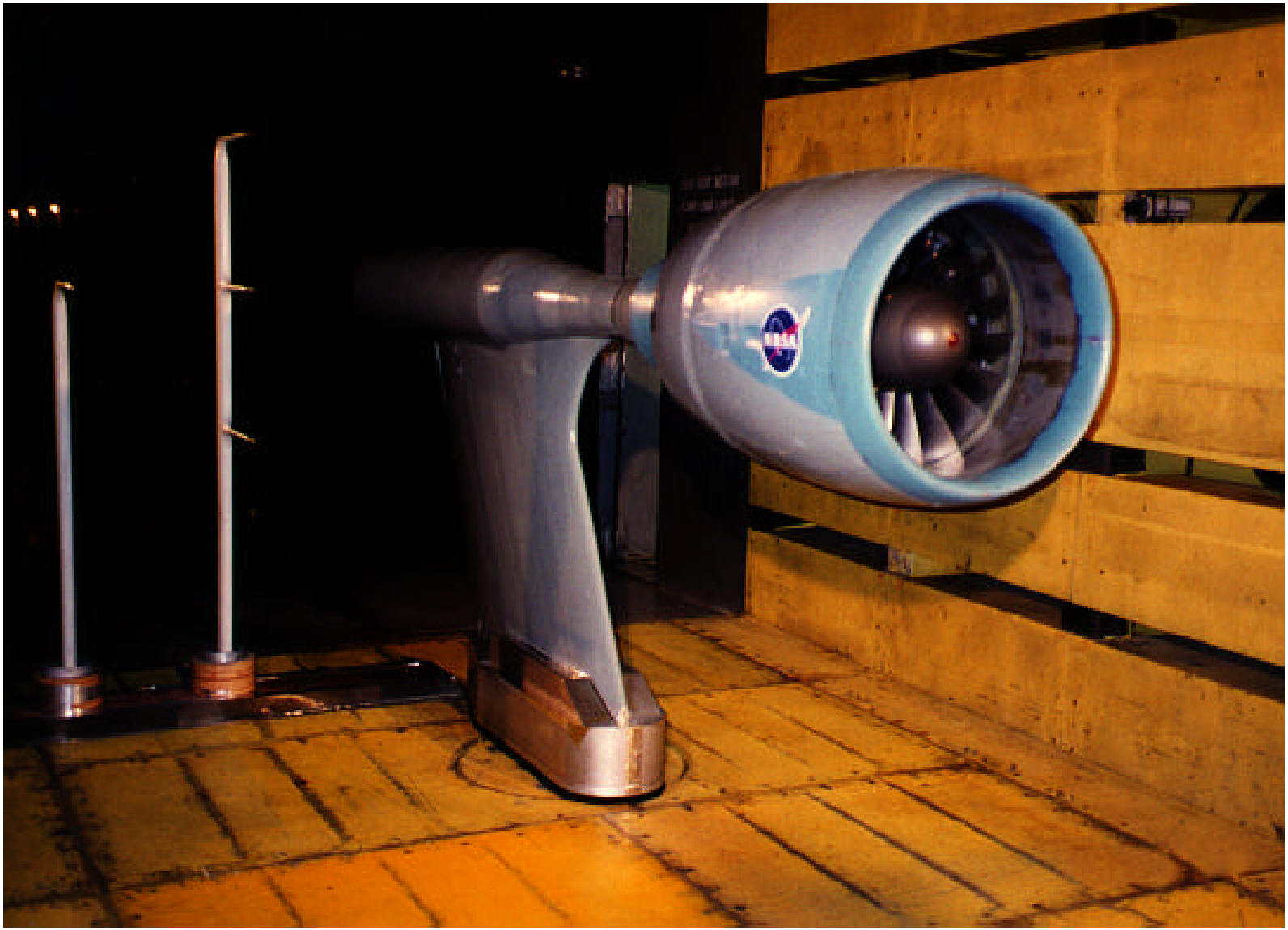


GRC is a Critical Component of the Agency Strategy



National Aeronautics and
Space Administration
Glenn Research Center

Optical Instrumentation Technology Branch



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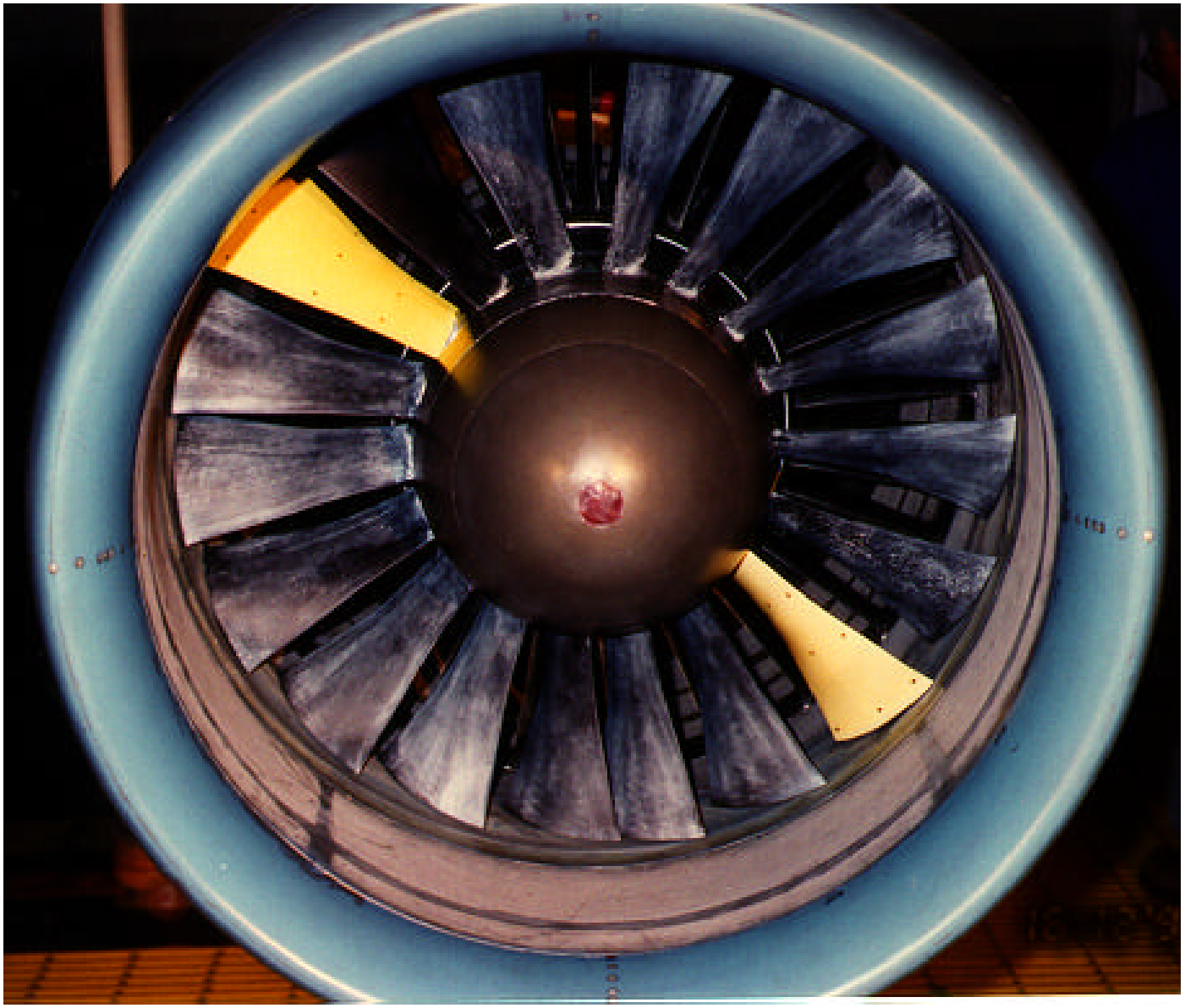
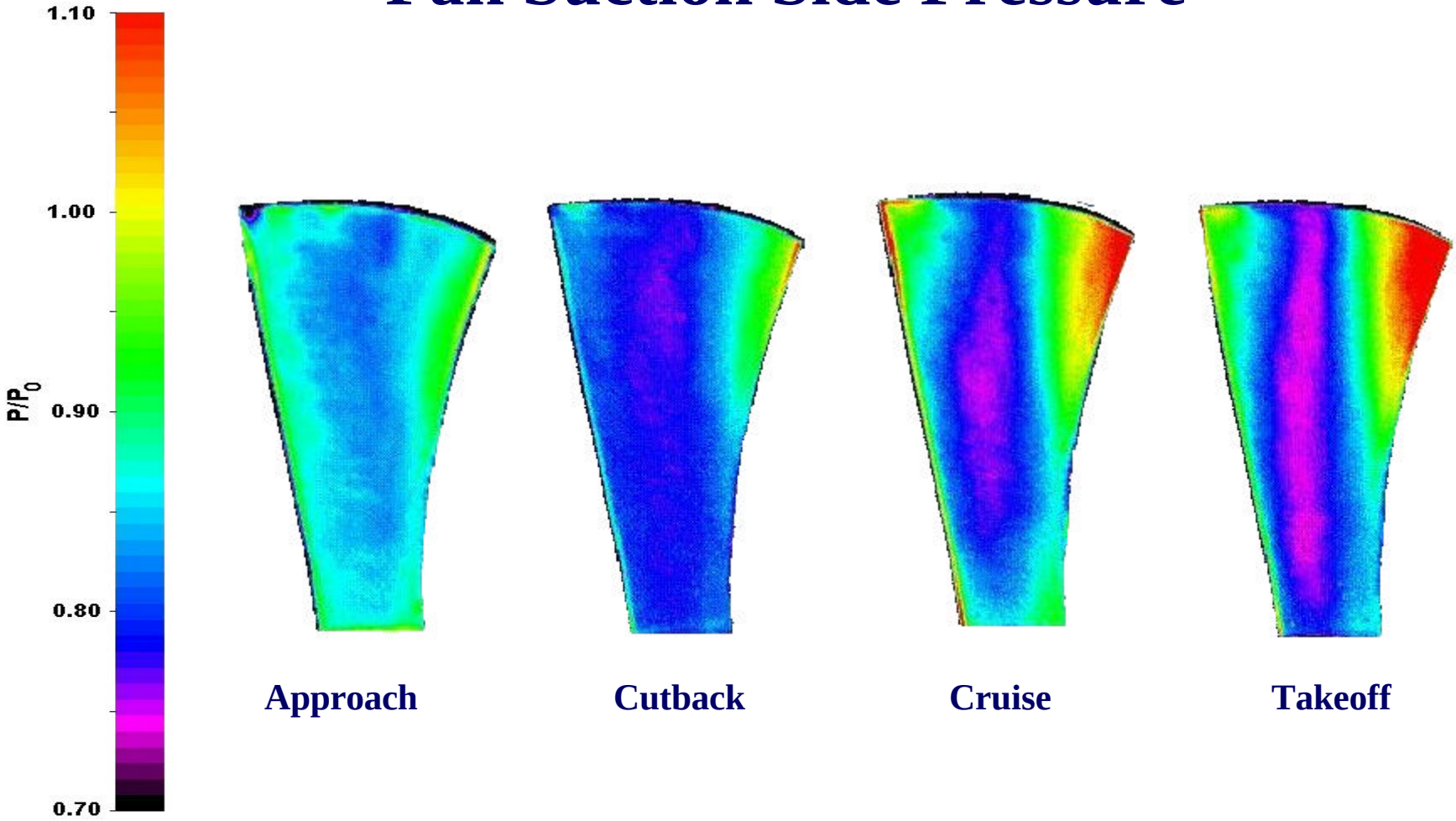
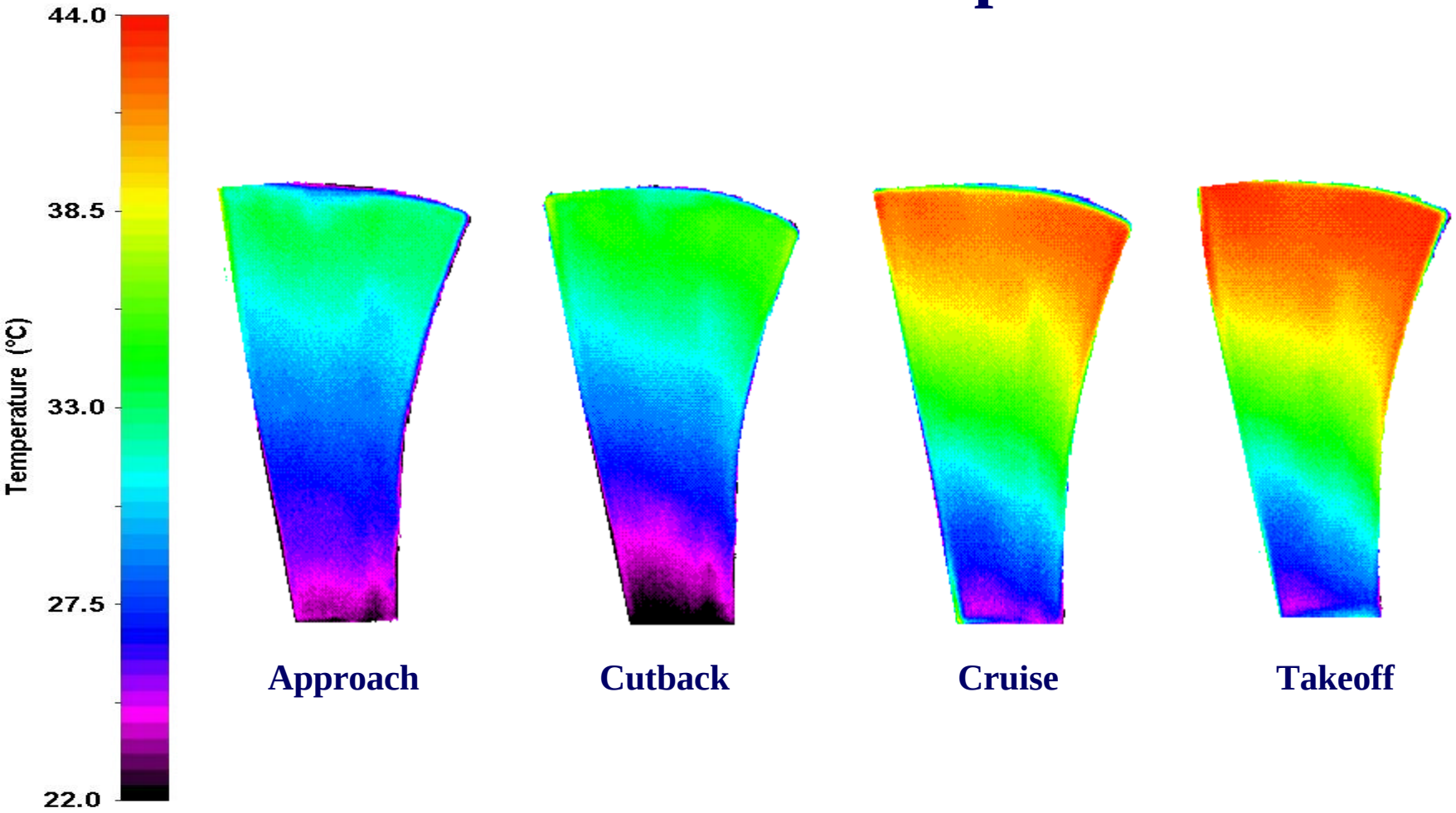


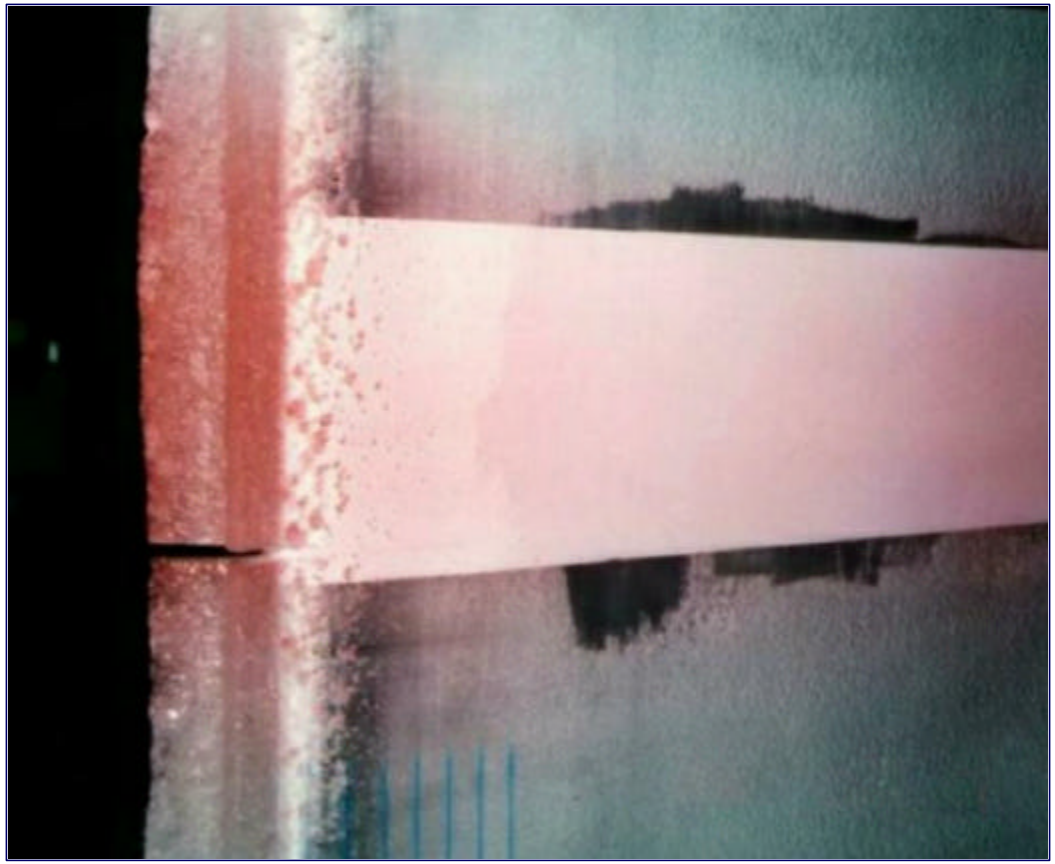
Fan Suction Side Pressure



Fan Suction Side Temperature



Wind tunnel model with PSP applied



Tracing of Ice shape

Conditions:

Vel= 103 m/s

Tt = -8° C

AOA = -0.4°

LWC = 0.9 g/m^3

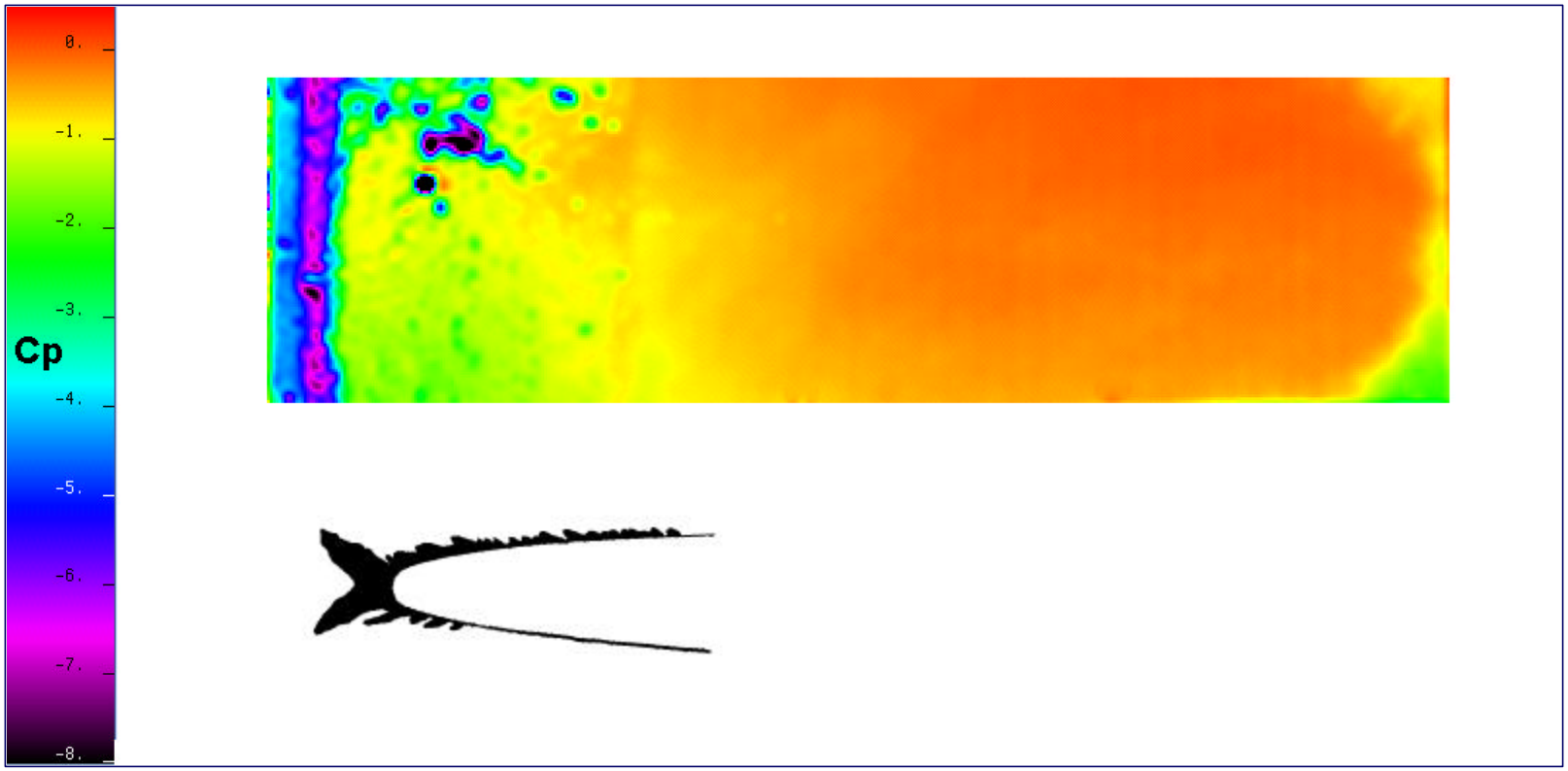
MVD = 28 µm

Spray = 5.4 min

Wind Tunnel Test

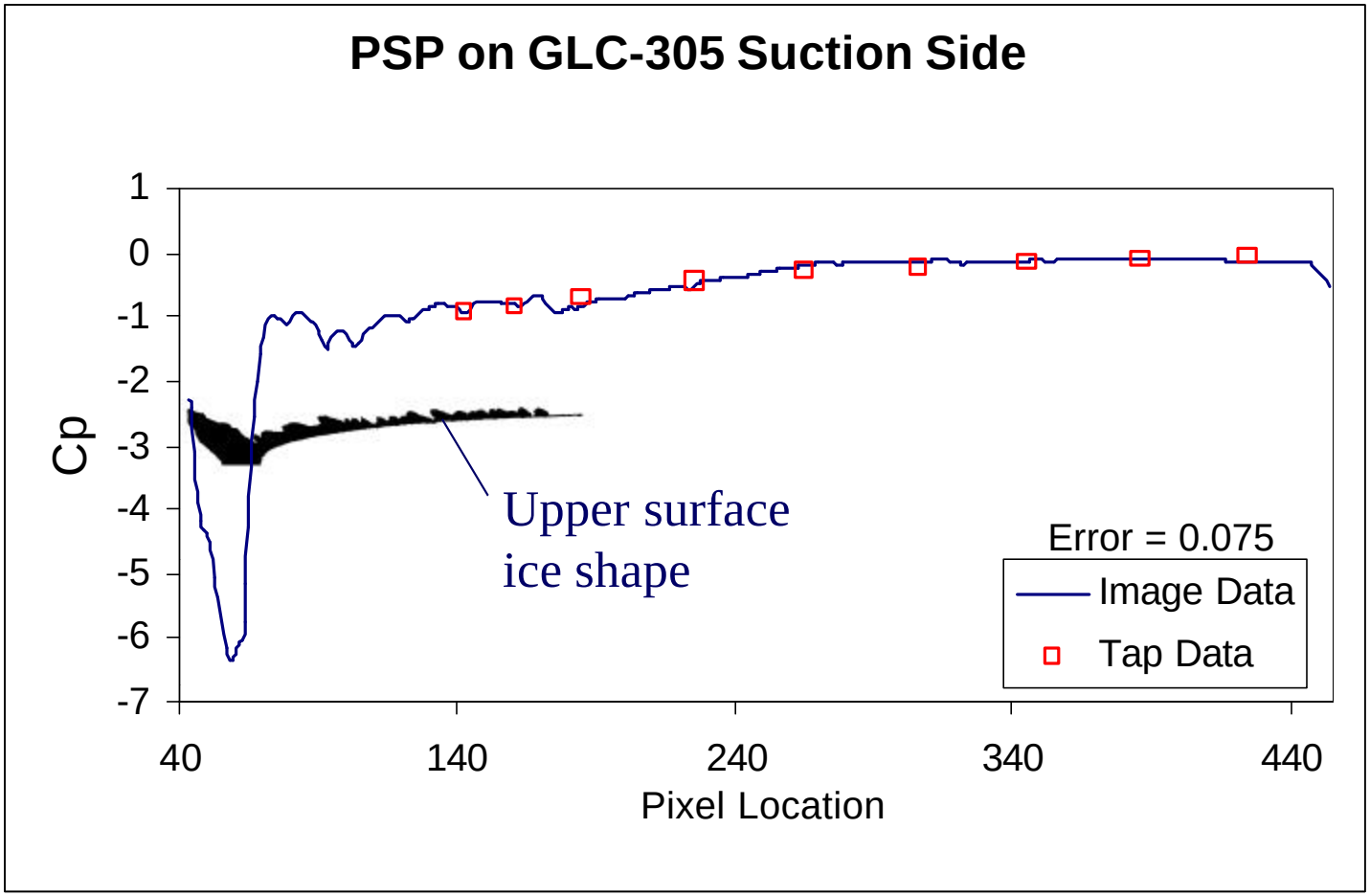
45.7 cm GLC-305, Suction side

V= 103 m/s, +3.6°AOA

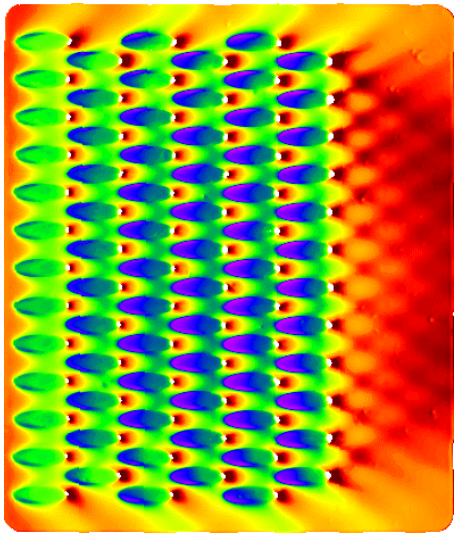


45.7 cm GLC-305 Suction side PSP data

V=103 m/s, AOA=3.6°, RMS_{Error}= 0.075



Conclusion



What has your pressure instrumentation missed?